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AIRS Science Processing Software

Version 5.0 Planning
Strategy and Goals

Steven Friedman
AIRS Science Processing

December 2, 2004

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Before we get started

- *A message from the AIRS System Administrator to the AIRS Science Team:*

- When you or someone who has access to JPL's AIRS computers leaves your organization, John Gieselman, the AIRS System Administrator must be notified.

- This is very important!
  - For security reasons
    as well as
  - Protection of project interests

- Contact John Gieselman at:
  John.Gieselman@jpl.nasa.gov
  818 354-7848

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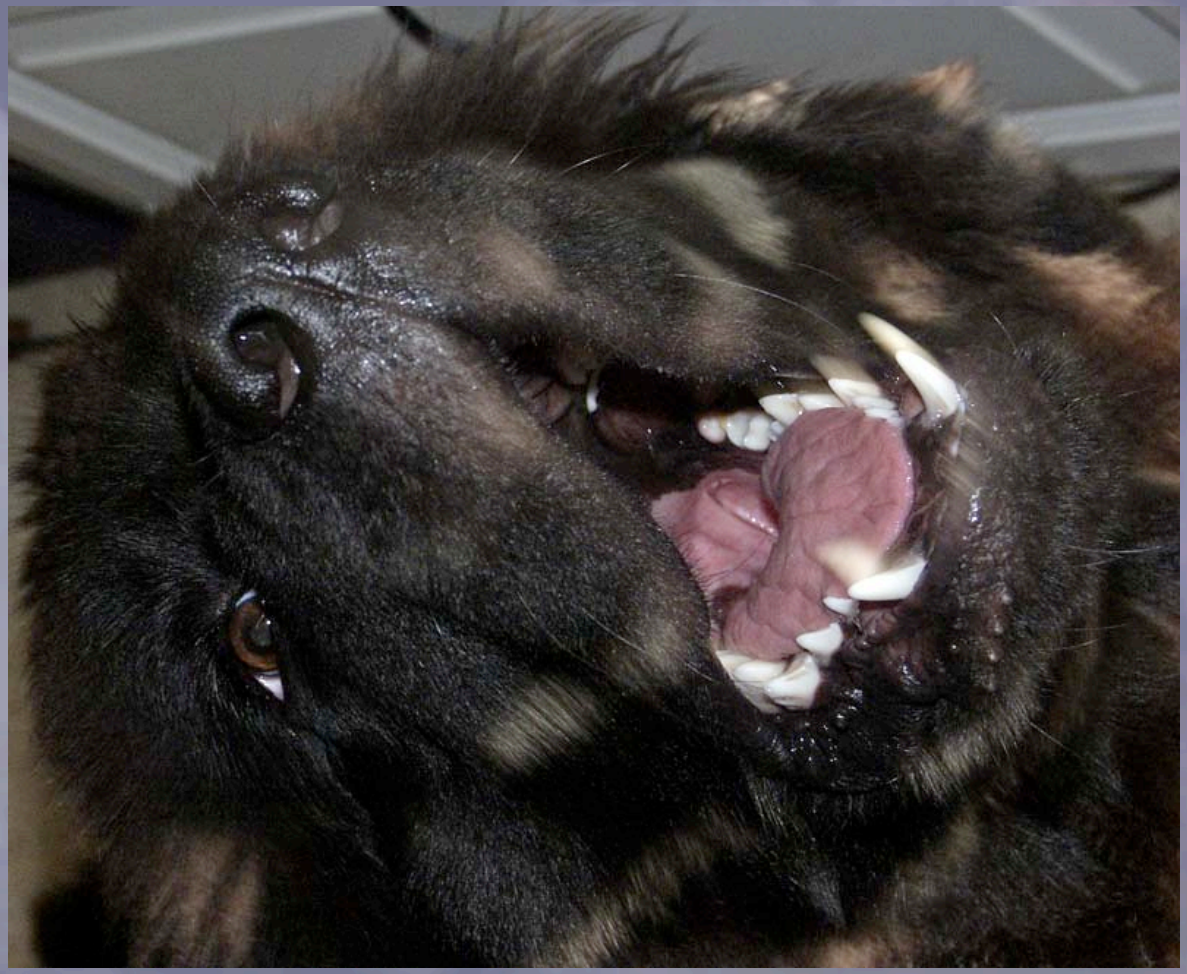
This is a dog of a topic!



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Improving the Experience

- **Version 4 was not as successful as envisioned:**
  - Insufficient planning
  - Insufficient time allocated to all phases of the effort
  - Schedule creep …
    Schedule slippage …
    Schedule slump …
    Schedule landslide …
  - Resulted in down-scaled expectations and release products
- **The Version 5 experience must be better to meet:**
  - Customer expectations
  - Sponsor expectations
  - Our expectations

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How do we do it?

- **Version 5 needs to be the very best!**
- **We can produce significantly better products if we start working key issues now**
- **We need to:**
  - Define Version 5 objectives
  - Define requirements in context of:
    - Validation Timeline
    - Project Office defined goals
  - Understand dependencies
  - Coordinate our efforts
  - Commit to meeting schedules
  - Develop and demonstrate new features before delivery
  - Deliver tested code
  - Allocate more time for integration and validation

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The Bottom Line

- **We need to develop a realistic plan for implementing V5**

- ***a plan that:***
  - clearly distinguishes research from production products
  - is workable
  - can meet schedule
  - is right-sized

- ***a plan that will produce effective products***

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Remember, We can make V5

Into a beautiful memory…

or…

a not so beautiful one

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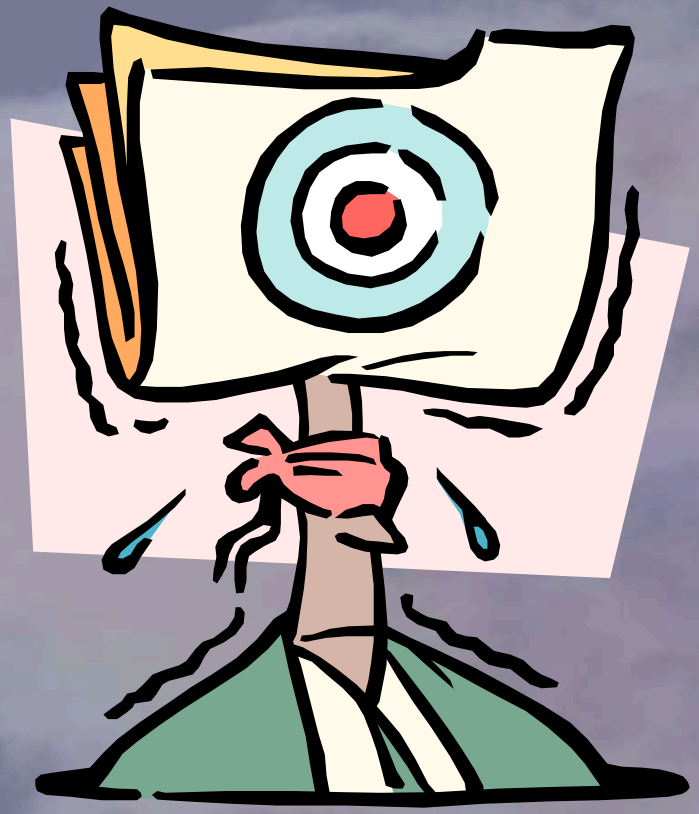
and,



Don’t shoot me. I am just the messenger

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Standard Product Activation / Validation Timeline

Version	3.0	4.0	5.0	6.0	7.0
Activation Date	9/15/03	2/1/05 rev	1/1/06	1/1/07	1/1/08
Radiance Products (L1)	Ocean	Land	Polar	Global	Global
AIRS Radiance	Prov	Val2	Val3	Val4	
VIS/NIR Radiance	Prov	Val2	Val3	Val4	
AMSU Radiance	Beta	Prov	Val2	Val3	Val4
HSB Radiance	Beta	N/A	N/A	N/A	N/A
Standard Products (L2)					
Cloud-Cleared IR Radiance	Beta	Val2	Val3	Val4	
Surface Temperature	Beta	Val1	Val2	Val4	
Temperature Profile	~~Beta~~ Prov	Val2	Val3	Val4	
Humidity Products	Beta	Val1	Val2	Val3	Val4
Cloud Cover Products	N/A	Val1	Val2	Val3	Val4

Beta = Not suitable for scientific investigations.

Prov = Provisionally validated. Useable for scientific investigations with caution. Validated for non-polar, night, ocean only.

Val1 = non-polar, day/night, ocean.
Val2 = Val1 + land.
Val3 = Val2 + polar
Val4 = Global All Cases

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Version 5 Project Office Objectives

- **Level 1**
  - Improve microwave standard products
- **Level 2**
  - Improved Error Estimation
  - Eliminate (or minimize) IR Tuning
  - Alternative Cloud Clearing methods (anticipation of eventual AMSU failure)
  - Include IR Spectral Emissivity in retrievals
  - Trace Gas Profiles: CO2, CO, CH4, O3, SO2, Aerosols
  - Extend validated retrievals to polar regions
  - Consensus clear flag
- **Level 3**
  - Quantization Product (added to existing set)
  - Formal error propagation (from Level 2)

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Methodology

- **Improved Project and Science Team Coordination**
  - Early definition of goals and objectives
  - Defined requirements and responsibilities
  - Coordinated schedules
  - More CCB involvement
- **Fewer software deliveries**
  - Demonstration of new features prior to incorporation into software baseline
  - Earlier integration into baseline
- **Longer validation period**

Roles – Science Team

- **Science Team Role**
  - **Develop and suggest new products**
  - **Enhance existing products**
  - When developing new or enhancing existing products:
    - Develop and follow a schedule
    - Demonstrate before delivery
    - Ensure code is tested before delivery
    - Deliver on time

Roles - JPL

- **JPL Role**
  - **Anticipate and plan** for coming changes
  - Integrate software into deliverable products
    - Developed at JPL
    - Developed outside JPL by Science Team
  - Implement and integrate software
  - Manage our coordinated efforts
  - Monitor our schedules

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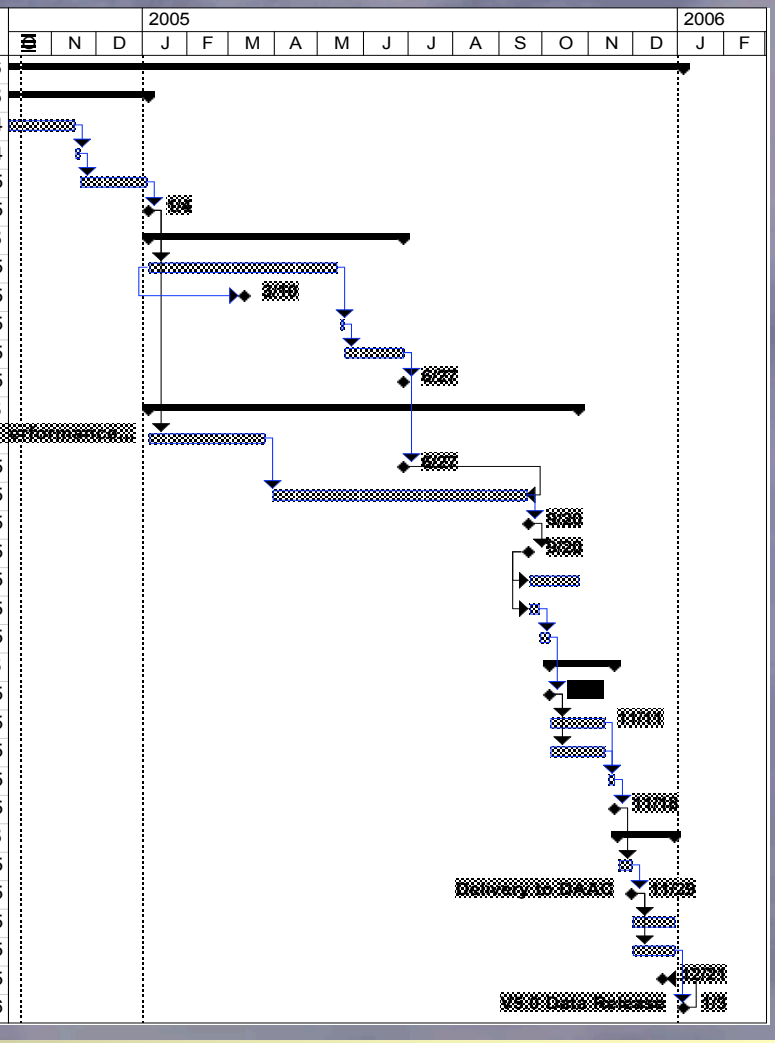
Schedule

ID	Task Name	Duration	Start	Finish
1	**V5.0 Development**	**340 days**	**Mon 8/23/04**	**Tue 1/3/06**
2	**Preliminary Planning**	**92 days**	**Mon 8/23/04**	**Tue 1/4/05**
3	Concept Development	60 days	Mon 8/23/04	Mon 11/15/04
4	Science Team Meeting	3 days	Tue 11/16/04	Thu 11/18/04
5	Solidify Requirements	28 days	Fri 11/19/04	Mon 1/3/05
6	Finalize contents and tasks	0 days	Tue 1/4/05	Tue 1/4/05
7	**Prototype and Characterization**	**121 days**	**Wed 1/5/05**	**Mon 6/27/05**
8	Initial proof of concept	91 days	Wed 1/5/05	Fri 5/13/05
9	In-Process Status report	0 days	Thu 3/10/05	Thu 3/10/05
10	Presentation of prelimnary res	2 days	Mon 5/16/05	Tue 5/17/05
11	Final development	28 days	Wed 5/18/05	Mon 6/27/05
12	Delivery of code	0 days	Mon 6/27/05	Mon 6/27/05
13	**Development and Integration**	**203 days**	**Wed 1/5/05**	**Mon 10/24/05**
14	In-house Improvements	56 days	Wed 1/5/05	Fri 3/25/05
15	Final Inputs to CCB	0 days	Mon 6/27/05	Mon 6/27/05
16	Development and Unit Test	120 days	Wed 3/30/05	Mon 9/19/05
17	CCB Approval to build 5.0	0 days	Tue 9/20/05	Tue 9/20/05
18	Initial build and delivery to TDS	0 days	Tue 9/20/05	Tue 9/20/05
19	Controlled Anomaly Quckfix	24 days	Wed 9/21/05	Mon 10/24/05
20	TDS SI&T	5 days	Wed 9/21/05	Tue 9/27/05
21	TDS end-to-end checkout	5 days	Wed 9/28/05	Tue 10/4/05
22	**Testing**	**33 days**	**Tue 10/4/05**	**Fri 11/18/05**
23	Operational in TDS	0 days	Tue 10/4/05	Tue 10/4/05
24	Sustained Testing	28 days	Wed 10/5/05	Fri 11/11/05
25	Validation Data Processing	28 days	Wed 10/5/05	Fri 11/11/05
26	Preship Review preparation	5 days	Mon 11/14/05	Fri 11/18/05
27	Preship Review	0 days	Fri 11/18/05	Fri 11/18/05
28	**Transfer V5.0 to DAAC**	**25 days**	**Mon 11/21/05**	**Thu 12/29/05**
29	Packaging and Shipping	5 days	Mon 11/21/05	Tue 11/29/05
30	Delivery to DAAC and NOAA	0 days	Tue 11/29/05	Tue 11/29/05
31	JPL Support to DAAC	20 days	Wed 11/30/05	Thu 12/29/05
32	DAAC I&T	20 days	Wed 11/30/05	Thu 12/29/05
33	Validation Report Due	0 days	Wed 12/21/05	Wed 12/21/05
34	Public Data Release V5.0	0 days	Tue 1/3/06	Tue 1/3/06



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V5 Key Activities

Activity	Dates
Conceptualization	Through December 2004
Prototype and characterization	Through May 2005
Delivery of code	No later than June 27, 2005
JPL integration and test	June – September 2005
Operational in TDS	October 2005
Validation data processing	Ends mid-November 2005
Delivery to GSFC DAAC	End-of-year 2005

Level 1 Activities

- **Overarching Goal:**

  – Make this our *last* Level 1 algorithmic delivery

- **Microwave**
  - Improve microwave standard products

- **Infrared**
  - No major issues

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Level 2 Activities

- Improved Error Estimation
- Eliminate (or minimize) IR Tuning
- Alternative Cloud-Clearing methodologies
- Include IR Spectral Emissivity in retrievals
- Trace Gas Profiles: CO2, CO, CH4, O3, SO2, Aerosols
- Extend validated retrievals to polar regions
- Consensus clear flag

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Summary of Issues for v5.0 (from Barnet)

	V4.0	RECOMMENDATION
Water convergence	QA Not tested 75% test on iter >= 2	QA & code mod to test on iter >= 4
All "75%" convergence	Tested on iter >= 2	code mod to test on (iter >= 4, reject if fails
Ozone Functions	7	10 or more
Ensemble error & null estimates.	Very low values for null estimate	Increase value
CO2 first guess	370 ppm	CO2 (time,latitude,p)
CO first guess	RTA reference profile, Fixed CD in PGE	Use MOPITT fixed mixing ratio profile, CO(p)
CO,CH4 rets	off	Turn them on in non-interactive mode

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Summary of Issues for v5.0 (cont'd.) (from Barnet)

	V4.0	RECOMMENDATION
T(p) AMSU Chl's	Not used in coupled ret	Use them, they impact residual tests & T(p) bias
Regression weight when CCR have high error.	Used 100%	Blend with AVN 300-surf w/ Aeff(1) as criteria or reject these cases.
NOAA synthetic emissivity regression	Spectral Shape is believed.	Don't use unless a better approach is found.
SVD emissivity retrieval	Severely Constrained	Investigate & implement other approach(es)
89 GHz tuning	Tuning Set to Zero	Fix empirical tuning or use empirical tuning value.
High Cij FOV's	Uses all FOV's	Test rejection of FOV's with poor Cij

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Improved Error Estimation

- **Science Team Component**
  - Recommend error propagation algorithms (Barnet, supported by Susskind)
  - Implement new / improved error propagation algorithms (Susskind)
- **JPL Component**
  - Improve microwave Level 1B error estimates
  - Examine alternative Level 2 error estimation algorithms
  - Verify efficacy through validation
  - JPL to investigate new solution spaces as backup plan
  - Level 3 products based on better error estimation

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Eliminate (or minimize) IR Tuning

- **Science Team Component:**
  - Modify retrieval to eliminate IR tuning step (GSFC – Susskind)
    - Examine ways to minimize or eliminate tuning
    - Re-evaluate definition of effective noise amplification factor
    - Stability over Time: Tuning, Regression, Biases …
    - Develop alternative first guess options
  - Analyze biases in cloud cleared radiances (UMBC – Strow)
  - Develop tuning based on high-quality radiosondes – as a fallback (NOAA – McMillin)
- **JPL Component**
  - Examine statistics with and without tuning – provide results to Science Team

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Alternative Cloud Clearing Methodologies

- **Science Team Component**
  - Recommend/Develop Algorithms (Barnet)
    - "Dirty" regression
    - MODIS
- **JPL Component**
  - Develop AVN First Guess for retrieval
    - Implement into PGE
    - Evaluate statistics, biases and trends
  - Investigate alternative algorithmic approaches
    - Clear FOV – Single footprint retrieval
    - Retrieval above cloud tops
    - Optimal estimation approach
  - Test algorithms within PGE

Several concepts were discussed this week.

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Include IR Spectral Emissivity in retrievals

- **Science Team Component**
  - Implement *surface temperature / emissivity* algorithm (Barnet)
  - Surface regression (Goldberg)
  - Deliver algorithm to JPL for evaluation (Knuteson)

Coordination between various approaches needed

- **JPL Component**
  - Lead investigation into alternative algorithms (Chahine)
  - Integrate Emissivity Algorithm into PGE
  - Test algorithm on sample clear data sets
  - Improved surface simulation (shortwave)
  - Develop, integrate and test as needed (various at JPL)

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Trace Gases, Aerosols, Cirrus

- **Science Team Component**
  - Develop RTA to model trace gas, aerosol and cirrus contributions (Strow)
  - Develop Aerosol Flag (Strow)
  - Develop software for CO, CO2, CH4 retrievals (Barnet, et al)
- **JPL Component**
  - Investigate alternative approaches for cirrus detection
  - Develop and Test trace gas algorithms (Chahine)
  - Provide input to Barnet (Chahine)
  - Ozone algorithm improvements
  - Integrate new algorithms into PGS

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Extend validated retrievals to polar regions

- **Science Team Component**
  - Help improve retrieval algorithm
  - Help identify and overcome problems
- **JPL Component**
  - Integrate code and algorithms
  - Perform validation

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Level 2: Phased Experiments

- ***We need to develop an integrated schedule to integrate:***
- **AVN First Guess**
  - JPL to try this on our baseline version 4.0
- **Remove IR Tuning**
  - Susskind/Strow to settle on approach
- **Modify Error Terms**
  - Susskind/Barnet to determine best method
- **IR Emissivity**
  - Barnet/Chahine to define algorithm
- **Alternative Cloud Clearing**
  - Chahine to develop algorithm. JPL/Barnet to support
- **Trace Gas Retrievals**
  - Barnet to develop code for PGE

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Level 3 Activities

- **Quantization Product**
  – *added to existing set*
- **Formal error propagation**
- **Precipitation estimate (GSFC – Susskind)**